CLAIMS

What is claimed is:

1. A power factor correcting power supply comprising:

an opposed current converter having an input and an output;

a power factor correction controller coupled with the opposed current converter, where the opposed current converter is directed by the power factor correction controller to control the waveshape of an AC line current supplyable to the input by a power source; and

an output stage power converter coupled with the output of the opposed current converter, where the output stage power converter is configured to provide isolation and voltage conversion of a DC boost voltage provided at the output of the opposed current converter.

2. The power factor correcting power supply of claim 1, where the opposed current converter is configured as a boost converter to receive un-rectified AC voltage on the input and supply DC boost voltage on the output.

3. The power factor correcting power supply of claim 1, where the power factor correction controller is configured to control the opposed current converter to regulate the DC boost voltage supplied at the output.

4. The power factor correcting power supply of claim 1, where the opposed current converter is directed by the power factor correction controller with frequency modulation to control electromagnetic interference.

5. The power factor correcting power supply of claim 1, where the opposed current converter includes a pair of boost switches each operable at a duty cycle and configured to be closeable at substantially the same center of time to control the waveshape of the AC line current.

6. The power factor correcting power supply of claim 1, where the opposed current converter includes a boost capacitor and a plurality of boost switches, the boost switches switchable by the power factor correction controller to charge the boost capacitor to the DC boost voltage.

7. The power factor correcting power supply of claim 1, where the output stage power converter includes a fixed frequency switch mode power converter and a transformer, the fixed frequency switch mode power converter configured to provide DC output voltage to a DC rail, and the transformer having galvanic isolation to minimize switching noise of the opposed current converter.

8. The power factor correcting power supply of claim 1, where the opposed current converter includes a first boost capacitor and a second boost capacitor coupled at a center point, where the centerpoint is configured to couple with a common of the power source, and each of the first and second boost capacitors are chargeable to the DC boost voltage.

9. A power factor correcting power supply comprising:

a power factor correction controller;

an opposed current converter coupled with the power factor correction controller, where the opposed current converter is configured to receive un-rectified AC input voltage and supply a DC boost voltage; and

an output stage power converter coupled with the opposed current converter and configured to receive the DC boost voltage and supply a DC output voltage,

where the power factor correction controller is configured with feedforward control to direct the opposed current converter as a function of the DC boost voltage.

10. The power factor correcting power supply of claim 9, where the opposed current converter comprises a half bridge converter that includes a first boost capacitor and a second boost capacitor coupled via a centerpoint, where the centerpoint is configured to couple with the common line of a power source.

11. The power factor correcting power supply of claim 9, where the opposed current converter includes a first boost switch and a second boost switch, the first and second boost switches are switchable with only one double edge natural pulse width modulated triangle wave that is scaleable by the power factor correction controller with the feedforward control.

12. The power factor correcting power supply of claim 9, where the opposed current converter is configured to operate with interleave, the opposed current converter directable by the power factor correction controller to operate with interleave to form a pulse width modulation voltage with an average waveform that is substantially identical to a sinusoidal waveform of the un-rectified AC input voltage.

13. The power factor correcting power supply of claim 9, where the opposed current converter comprises a plurality of opposed current converters coupled in parallel to supply the DC boost voltage.

14. The power factor correcting power supply of claim 9, where the opposed current converter comprises a plurality of opposed current converters coupled to form a full bridge converter.

15. The power factor correcting power supply of claim 14, where the full bridge converter is operable with an interleave of four.

16. The power factor correcting power supply of claim 9, where the opposed current converter comprises a plurality of opposed current converters coupled to form a plurality of full bridge converters, where the full bridge converters are coupled in series.

17. The power factor correcting power supply of claim 9, where the opposed current converter comprises a plurality of opposed current converters, each of the opposed current converters configured to couple with one phase of a three phase power source.

18. The power factor correcting power supply of claim 9, where the power factor correction controller is further configured to direct the opposed current converter as a function of at least one of the DC output voltage and a rectified AC input current.

19 A power factor correcting power supply comprising:

an opposed current converter configured to receive an AC input voltage and an AC input current and supply a DC boost voltage,

where the opposed current converter includes a first boost switch and a second boost switch having a duty cycle, the first and second boost switches closeable concurrently during the duty cycle; and

means for controlling power factor coupled with the opposed current converter, where the means for controlling power factor is configured to control the duty cycle of the first and second boost switches to adjust a waveform of the AC input current to improve power factor.

20. The power factor correcting power supply of claim 19, further comprising means for converting the DC boost voltage to a desired DC output voltage.

21. The power factor correcting power supply of claim 20, where the means for controlling power factor is configured to regulate the desired DC output voltage as a function of the DC boost voltage.

22. The power factor correcting power supply of claim 20, where the means for controlling power factor is configured to regulate the desired DC output voltage as a function of the DC boost voltage and the desired DC output voltage.

23. The power factor correcting power supply of claim 20, where the means for controlling power factor is configured to regulate the desired DC output voltage as a function of the DC boost voltage, the desired DC output voltage and the AC input current.

24. The power factor correcting power supply of claim 20, where the means for converting the DC boost voltage is configured to galvanically isolate the desired DC output voltage from the opposed current converter.

25. The power factor correcting power supply of claim 19, where the means for controlling power factor is configured with feed forward control to control the duty cycle as a function of the magnitude of the AC input voltage.

26. A power factor correcting power supply comprising:

an input stage power converter that includes an opposed current converter coupled with a power factor correction controller,

where the opposed current converter includes a boost capacitor, a boost inductor and a pair of boost switches operable at a duty cycle, the pair of boost switches configured to be closed concurrently during a portion of the duty cycle to magnetize the boost inductor,

the pair of boost switches configured to each be opened during a portion of the duty cycle to charge the boost capacitor to a first DC voltage,

where interleaved switching of the pair of boost switches is controllable by the power factor correction controller to regulate the first DC voltage and to control a waveform of an AC input current supplyable to the input stage power converter; and

an output stage power converter coupled with the input stage power converter, where the output stage power converter is configured to convert the first DC voltage to a second DC voltage that is isolated from the first DC voltage.

27. The power factor correcting power supply of claim 26, where the input stage power converter is configured to consume power from a power source and provide power to the power source as directed by the power factor correction controller.

28. The power factor correcting power supply of claim 26, where the pair of boost switches is controllable by the power factor correction controller to form a pulse width modulation voltage having a sinusoidal waveform with an average amplitude that is substantially similar to an amplitude of a waveform of an AC input voltage to improve power factor.

29. The power factor correcting power supply of claim 26, where the output stage power converter comprises a series resonant switch mode converter.

30. The power factor correcting power supply of claim 29, where the output stage power converter is configured to operate with fixed frequency in a discontinuous current mode.

31. The power factor correcting power supply of claim 26, where the output stage power converter comprises a full bridge switch mode converter.

32. The power factor correcting power supply of claim 26, where the output stage power converter comprises a half bridge switch mode converter.

33. The power factor correcting power supply of claim 26, further comprising a softstart circuit coupled with the input stage power converter, where the softstart circuit includes a plurality of switches and a resistor to selectively limit AC input current supplied to the input stage power converter.

34. The power factor correcting power supply of claim 26, further comprising a line filter coupled with the input stage power converter to minimize electromagnetic interference.

35. A power factor correcting power supply comprising:

a power factor correction controller; and

an opposed current converter coupled with the power factor correction controller,

where the opposed current converter includes an input and an output,

the opposed current converter controllable by the power factor correction controller as a function of a DC boost voltage supplied at the output to regulate the magnitude of the DC boost voltage,

the opposed current converter also controllable by the power factor correction controller to control the waveshape of an AC input current supplyable to the input by a power source.

36. The power factor correcting power supply of claim 35, where the opposed current converter includes a boost capacitor, the boost capacitor chargeable to the DC boost voltage.

37. The power factor correcting power supply of claim 36, where the boost capacitor is a plurality of boost capacitors and each of the boost capacitors is chargeable to the DC boost voltage.

38. The power factor correcting power supply of claim 35, further comprising a current sensing device coupled with the power factor correction controller, the current sensing device configured to sense the AC input current, the power factor correction controller configured to regulate the DC boost voltage and control the waveshape of the AC input current as a function of the DC boost voltage and the AC input current sensed by the power factor correction controller.

39. The power factor correcting power supply of claim 35, where the opposed current converter includes a pair of boost switches, the pair of boost switches having a duty cycle controllable by the power factor correction controller to regulate the DC boost voltage and control the waveshape of the AC input current.

40. The power factor correcting power supply of claim 39, where the pair of boost switches are configured to be closed at the same time during some portion of each duty cycle.

41. The power factor correcting power supply of claim 39, where the duty cycle of the pair of boost switches is controllable by the power factor correction controller to be substantially unity.

42. The power factor correcting power supply of claim 39, where the power factor correction controller is configured to scale a modulation waveform to be proportional to the DC boost voltage, where the pair of boost switches are switchable by the power factor correction controller with the modulation waveform.

43. The power factor correcting power supply of claim 38, where the power factor correction controller is configured to control the DC boost voltage with an output voltage feedback control loop as a function of the AC input current sensed by the power factor correction controller.

44. The power factor correcting power supply of claim 35, where the power factor correction controller includes an input voltage feedforward control loop, an output voltage feedback control loop and a voltage controlled inner loop, where the DC boost voltage is supplied as a feedforward control signal to the voltage controlled inner loop.

45. The power factor correcting power supply of claim 35, where the output of the opposed current converter is configured to be coupled with an output stage power converter, the output stage power converter includes a switch mode converter and a transformer to provide isolation and voltage conversion of the DC boost voltage provided at the output of the opposed current converter.

46. A method of performing power factor correction with a power factor correcting power supply, the method comprising:

providing an AC power source having an AC input voltage and an AC input current;

converting the AC input voltage to a first DC voltage with an opposed current converter controlled by a power factor correction controller;

transforming the first DC voltage to a second DC voltage with an output stage power converter; and

supplying the second DC voltage to a power rail to supply a load.

47. The method of claim 46, where converting the AC input voltage to a first DC voltage comprises regulating the second DC voltage to a desired magnitude as a function of the first DC voltage.

48. The method of claim 46, where the opposed current converter includes a plurality of boost inductors and a plurality of boost capacitors and the act of converting the AC input voltage to the first DC voltage comprises:

magnetizing one of the boost inductors with the AC power source and a first boost capacitor; and

demagnetizing the one of the boost inductors to charge a second boost capacitor.

49. The method of claim 46, where converting the AC input voltage to the first DC voltage comprises switching a first boost switch and a second boost switch included in the opposed current converter to be closed at substantially the same center of time to sequentially magnetize and demagnetize a first boost inductor and a second boost inductor also included in the opposed current converter.

50. The method of claim 46, where converting the AC input voltage to the first DC voltage comprises creating a pulse width modulation voltage with the opposed current converter to charge a boost capacitor included in the opposed current converter to the first DC voltage.

51. The method of claim 50, where creating the pulse width modulation voltage comprises regulating the relative magnitude of the pulse width modulation voltage to be less than the relative magnitude of the AC input voltage to provide power to the power rail.

52. The method of claim 50, where creating the pulse width modulation voltage comprises adjusting an average amplitude of a sinusoidal waveform of the pulse width modulation voltage to be substantially similar to an amplitude of a waveform of the AC input voltage to improve power factor.

53. A method of performing power factor correction with a power factor correcting power supply, the method comprising:

providing an AC power source having an AC input voltage and an AC input current;

converting the AC input voltage to a DC voltage with an opposed current converter controlled by a power factor correction controller;

decreasing a magnitude of a pulse width modulation voltage created by the opposed current converter from the AC input voltage to increase the flow of AC input current into the opposed current converter; and

increasing the magnitude of the pulse width modulation voltage to decrease the flow of AC input current into the opposed current converter.

54. The method of claim 53, where decreasing and increasing the magnitude of the pulse width modulation voltage comprises regulating the DC voltage with the power factor correction controller as a function of the DC voltage.

55. The method of claim 53, where decreasing and increasing the magnitude of the pulse width modulation voltage comprises tracking the AC input voltage with the pulse width modulation voltage during quiescence conditions.

56. The method of claim 53, where decreasing and increasing the magnitude of the pulse width modulation voltage comprises scaling a modulating triangle waveform to be proportional to the DC voltage with the power factor correction controller.

57. The method of claim 53, where decreasing and increasing the magnitude of the pulse width modulation voltage comprises performing feedforward control of the DC voltage with the DC voltage and performing feedback control of the DC voltage with the AC input current.

58. The method of claim 53, further comprising maintaining an average amplitude of the pulse width modulation voltage substantially the same as an amplitude of the AC input voltage.

59. The method of claim 53, where the opposed current converter includes a first boost switch and a second boost switch, and decreasing the magnitude of the pulse width modulation voltage comprises decreasing an on-time portion of a duty cycle of the first boost switch and increasing an on-time portion of a duty cycle of the second boost switch, where both the first and the second boost switches are closed concurrently during part of each duty cycle.

60. The method of claim 59, where increasing the magnitude of the pulse width modulation voltage comprises increasing the duty cycle of the first boost switch and decreasing the duty cycle of the second boost switch.